

in the herbarium of Cornell University, he has consulted the collections of others as well.

The diversity of topics treated in the introduction reflects the author's wide botanical interests. An interesting feature is the presentation of lists of those species characteristic of such distinctive habitats as alpine meadows, salt marshes, gravelly prairies and coastal cliffs. A brief account of the zonation of vegetation is handsomely illustrated by carefully selected photographs. A conveniently classified list is offered of plants deemed suitable for cultivation.

In the annotated catalogue, which constitutes two-thirds of the book, the genera and species are alphabetically arranged under the systematically ordered families. Neither keys nor descriptions are provided. The abundance and characteristic habitats of each species are described and authenticating specimens are cited for each. It thus becomes possible for the perennially skeptical specialist to check the identity of every item attributed to the group with which he is especially concerned.

The taxonomic treatment is, on the whole, conservative, and pretty thoroughly up to date. The current bitter controversy between the advocates of "subspecies" and the proponents of "varieties" is met by calling all subspecific entities, except forms, "varieties," and retaining the original authors of the trinomials, regardless of whether they designated the subspecific or varietal category. This has the curious effect of attributing "varieties" to such authors as Hall and Clements, Piper, and Pennell, which will probably bring down the wrath of both factions. There is also some inconsistency in the capitalization of specific names, which will doubtless provide ammunition for the arsenal of those advocating uniform decapitalization.

This flora is, happily, much more than an unusually complete and attractively prepared catalogue of the plants of one western county. Because of the wide range of habitats and altitudes contained in this one political division, it is essentially a catalogue of the flora of western Washington. It is to be hoped that the completion of this very satisfactory study will encourage the preparation of other much needed local floras throughout the west.—L. CONSTANCE, Department of Botany, University of California, Berkeley.

Experimental Studies on the Nature of Species. I. Effect of Varied Environments on Western North American Plants. By JENS CLAUSEN, DAVID D. KECK AND WILLIAM M. HIESEY. Carnegie Institution of Washington publication 520. Pp. vii + 452. 1940. Paper, \$3.50. Bound, \$4.50.

This stimulating volume represents the application of methods in experimental taxonomy to an understanding of the involved intrarelationship of several complicated groups of species. The application of the method to specific problems serves in this case

as a vehicle to outline the method of research. The groups of plants selected are *Potentilla glandulosa* and its allies, *P. gracilis* and its allies, *P. Drummondii* and *P. Breweri*, *Horkelia fusca* and *H. californica*, the genus *Zauschneria*, certain groups of *Penstemon*, the *Achillea millefolium* complex, the *Artemisia vulgaris* complex and a large number of well selected minor problems in groups ranging from the Gramineae through the Compositae. The volume is prefaced with a short historical sketch of the research project; a brief tribute is paid to the late Dr. Harvey Monroe Hall under whose able direction the work was begun. It is a point of major interest that the authorship should include a cytogeneticist, a taxonomist and a plant physiologist.

In establishing the experimental method the problem was approached from many points of view and several methods were tried and discarded before the final procedure was adopted. The plant materials selected were those that could be used as clone transplants. A clone is defined by the authors as "all asexual propagules derived from one individual." These were subjected to varied environments: cytogenetic studies were made: a revised taxonomic analysis was presented based upon the results of these experiments. The terminology follows closely that of Turesson.

For purposes of review the treatment of *Potentilla glandulosa* and its allies (section *Drymocallis*) affords an illustration of the mode of attack. This group had received varied and haphazard treatment at the hands of the old school taxonomists. It was selected because of its widespread vertical and horizontal distribution, its great variability and its ready adaptability to garden manipulation. Specifically, California ecotypes from the following stations were used: Coast Range; Sierra Nevada, foothill, mid-altitude meadow, subalpine and alpine. These differed morphologically and showed some variability in seasonal rhythm. They possessed the uniform chromosome number $n = 7$. There are no genetic barriers between them. Clone transplants of each ecotype were established in California at three stations: a coastal station at Stanford University, a middle station at Mather, and a timberline station near Saddlebag Lake. The latter stations are in the Sierra Nevada.

Observations were made to determine constant characters, seasonal differences, effects of light and moisture differences and effects of altitude. The reversibility of environmental modifications was established for some ecotypes by taking clone members of changed individuals back to the original environment.

In general it was found that each ecotype retained a certain individuality in all three stations. This was regarded as being due to the sum total of hereditary characters. Each responded to the different environments in a very characteristic way; these changes (modifications) were superimposed over the hereditary characters. While morphological change was slight the annual cycle or response to the rhythm of seasonal events was profoundly

changed. In some cases, however, this change was not sufficient to insure survival.

Cytogenetic studies had as their objective "to interpret the taxonomic status of the various forms by testing the degrees of genetic relationship, to explore their evolutionary background by analysis of gene or chromosome differences and to determine their utility for various ecogenetic investigations." In determining whether they were dealing with ecospecies or ecotypes the following criteria were adopted: Crosses between ecotypes would produce a second generation in which the parental genes would be recombined in all proportions without resulting in constitutional weakness of the offspring. In crosses between ecospecies the genic recombinations would produce many constitutionally weak offspring which would barely survive under favorable conditions. Thus there would be constitutional weakness plus environmental unfitness in the offspring of the cross between ecospecies. It has been established in such species of the section *Drymocallis* as have been studied that the "diversity distinguishing ecotypes and ecospecies has been produced by a simple genic differentiation." Genic incompatibility, they report, is slight. It was found that hybrids between the ecotypes were easily produced and fully fertile and the conclusion was drawn that they were true ecotypes of a large and variable ecospecies. The authors conclude that "*Potentilla glandulosa* presents a picture of evolutionary differentiation into ecologic units, the ecotypes, which are not separated from each other by breeding barriers. The ecotypes fit their specific climates and differ by many characters, both physical and morphological. Each of these characters appears to be determined by a series of genes, and is often genetically linked with others. The many differences in genes with minute effect furnish the basis for the multiplicity of intergrading forms observed in nature, and the linkage relations suggest a reason for the limited number of taxonomic units that can be recognized in spite of recombinations and lack of internal barriers."

As a result of many such experimental studies certain general conclusions are drawn relative to the problems of regional differentiation. These are discussed in the form of eleven laws governing the nature of modification, its genetic limitations and environmental control and the bearing of modification and genetic differentiation on the development of regional races. Regional races are interpreted as ecotypes or ecospecies which have developed in harmony with their environment through genic differentiation of one sort or another and are under the control of natural selection. Regional differentiation implies discrimination between unlike environments. These units, the ecotype and the ecospecies, are regarded as the natural units of ecological and evolutionary behavior. These conclusions are in close agreement with Turesson's statements regarding the genotypical response of the plant species to its habitat.

The volume is replete with tables and graphs giving comparative measurements of the plant and its parts as it developed in the different environments. Photographic illustrations of plants and of specimen vouchers provide convincing demonstration of the results obtained.

This work at once becomes a classic in the field of experimental taxonomy. Regardless of agreement or disagreement as to precise limitation in the definition of species the problem of the pattern of relationship within closely allied groups is clearly set forth by such methods as these. Obviously it will be impossible to subject all plant groups to similar experimentation. It is hoped, however, that enough such work can be done to complete the picture of the nature of relationships in plants so that a pattern can be established into which such plants as are not adaptable to this mode of treatment can be placed.—HERBERT L. MASON.

NOTES AND NEWS

The following monographic studies and other important taxonomic articles have appeared recently: "preliminary list of desmids of the Pacific Northwest with descriptions of some new forms," by Gordon D. Alcorn (Occas. Papers, Dept. Biol. Coll. Puget Sound, no. 10, 1-200, pls. 1-8. 1940); "the North American sub-divisions of *Ranunculus*," by Lyman Benson (Amer. Journ. Bot. 27: 799-807, 17 figs. 1940); "a revision of *Laurentia* and allied genera in North America," by Rogers McVaugh (Bull. Torr. Bot. Club 67: 778-798. 1940); "new combinations and new names in the Umbelliferae," by Mildred Mathias and Lincoln Constance (Bull. Torr. Bot. Club 68: 121-124. 1941); "a revision of *Choisya*," by Cornelius G. Muller (Amer. Midland Nat. 24: 729-742, 7 figs. 1940); "the American species of *Hippocrateaceae*," by A. C. Smith (Brittonia 3: 341-355, 12 figs. 1940); "a revision of the genus *Chaenactis*," by Palmer Stockwell (Contrib. Dudley Herb. 3: 89-168, pls. 22-45. 1940).

Recent articles of general interest to botanists are: "late Tertiary floras of the Great Basin and border area," by Daniel I. Axelrod (Bull. Torr. Bot. Club 67: 477-487. 1940); "some features of the structure of *Toxicodendron diversilobum*," Herbert F. Copeland and Bernice E. Doyel (Amer. Journ. Bot. 27: 932-939. 1940); "history of botanical exploration in Alaska and Yukon territories from the time of their discovery to 1940," by Eric Hultén (Botaniska Notizer 1940: 289-346. 1940); "Arizona localities of interest to botanists," compiled by T. H. Kearney (mimeographed, received 1941); "additional nomina generica conservanda: Pteridophyta and Phanerogamae," by T. A. Sprague (Kew Bull. Misc. Inf. no. 3: 81-134. 1940); "Gramineae of Nevada," by Jason R. Swallen (Contributions toward a flora of Nevada, no. 1, mimeographed, Washington, D. C.).—ETHEL CRUM.